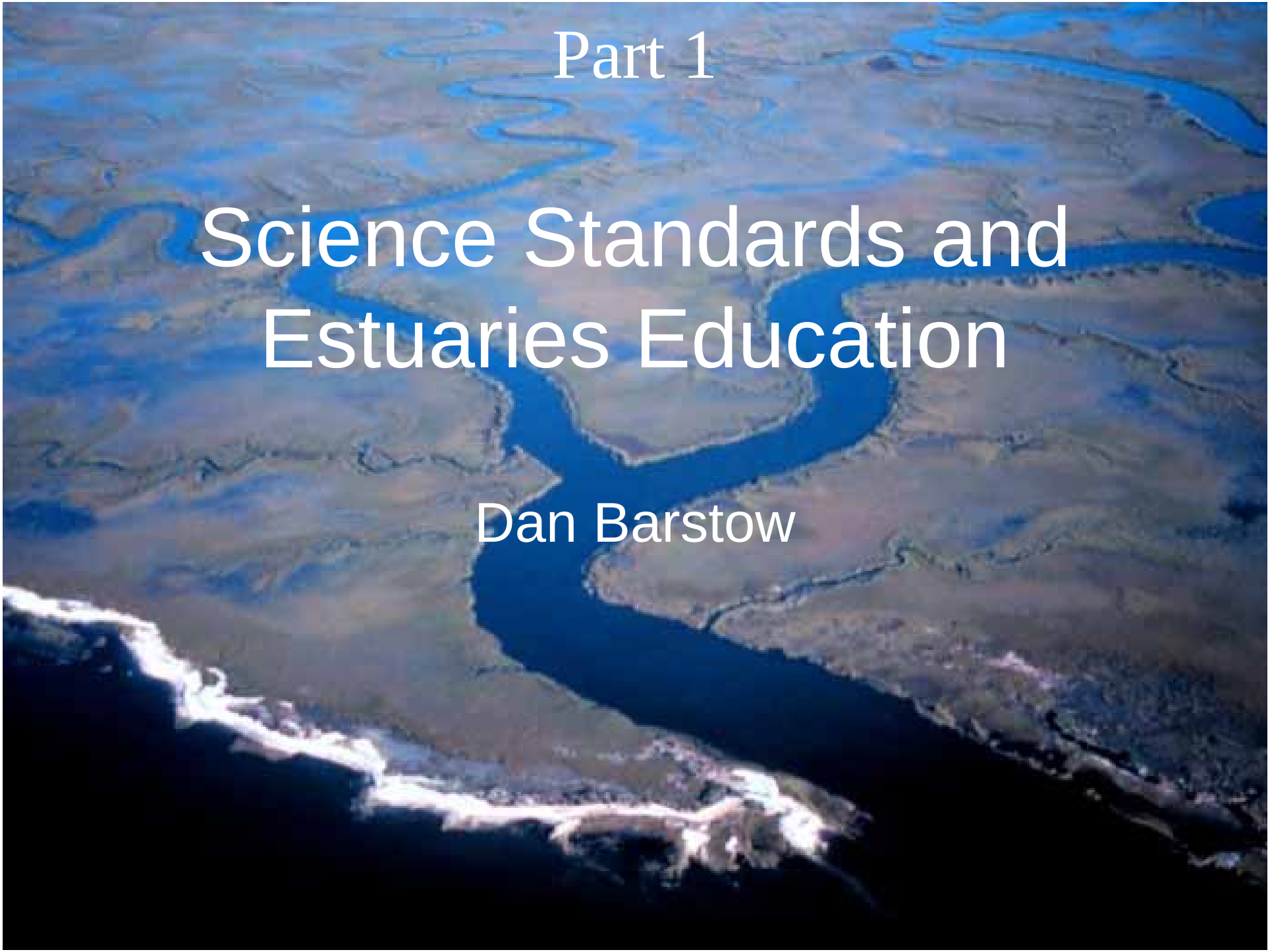
Estuarine Education
and
National Review of State Standards

Dan Barstow

Martos Hoffman

TERC
Center for Science Teaching and Learning

NOAA EDUCATION COUNCIL MEETING
November 15, 2006

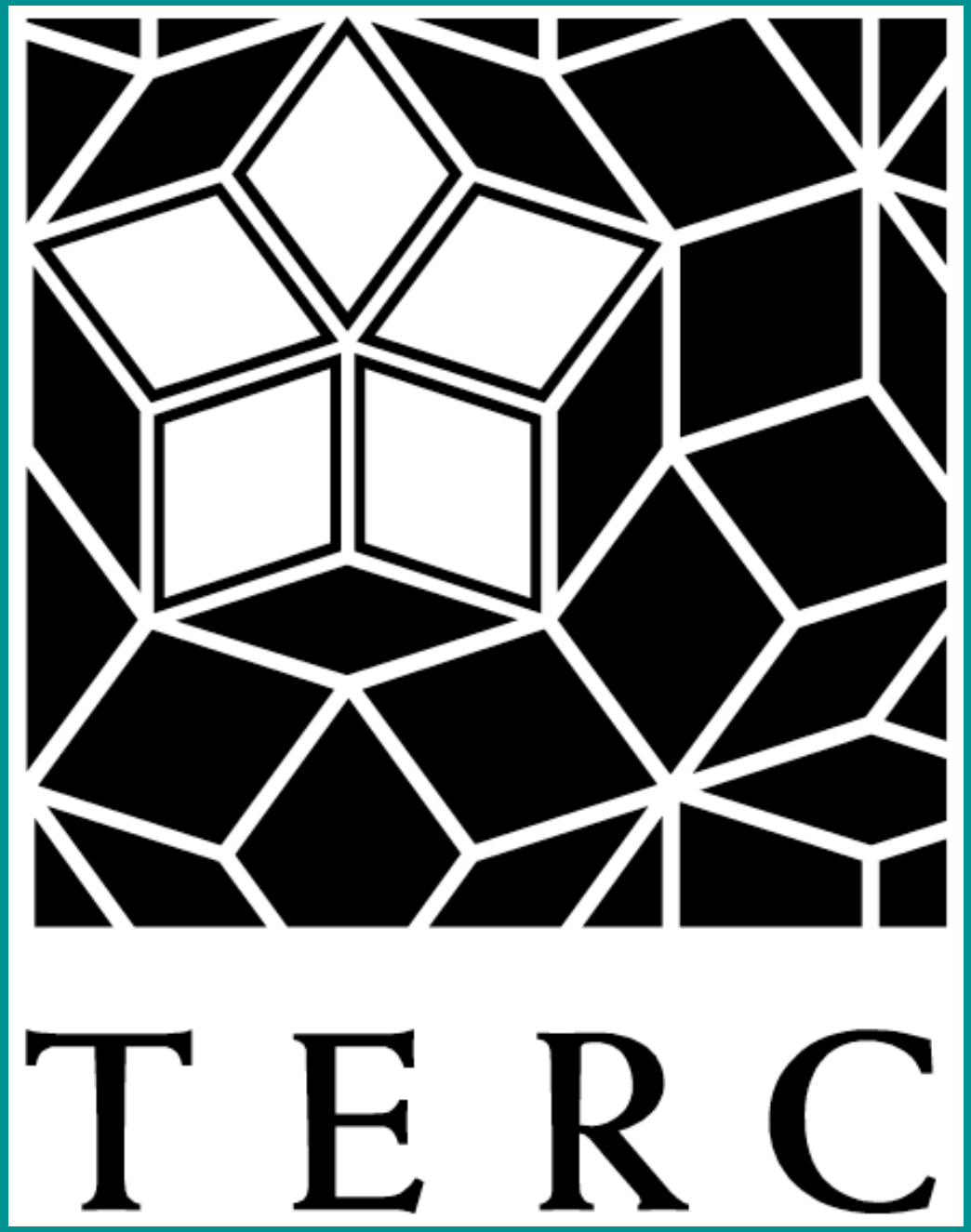


Part 1

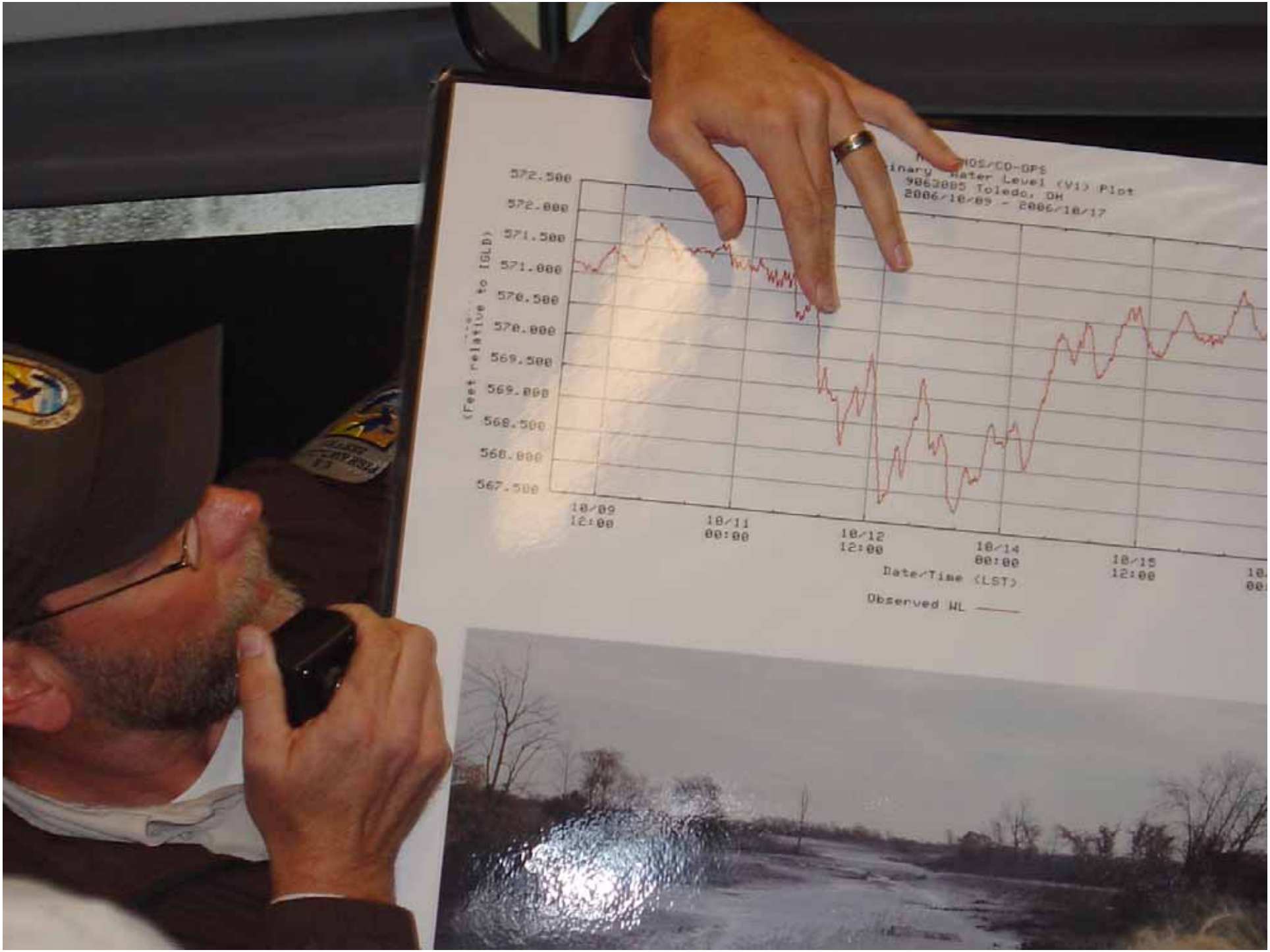
Science Standards and Estuaries Education

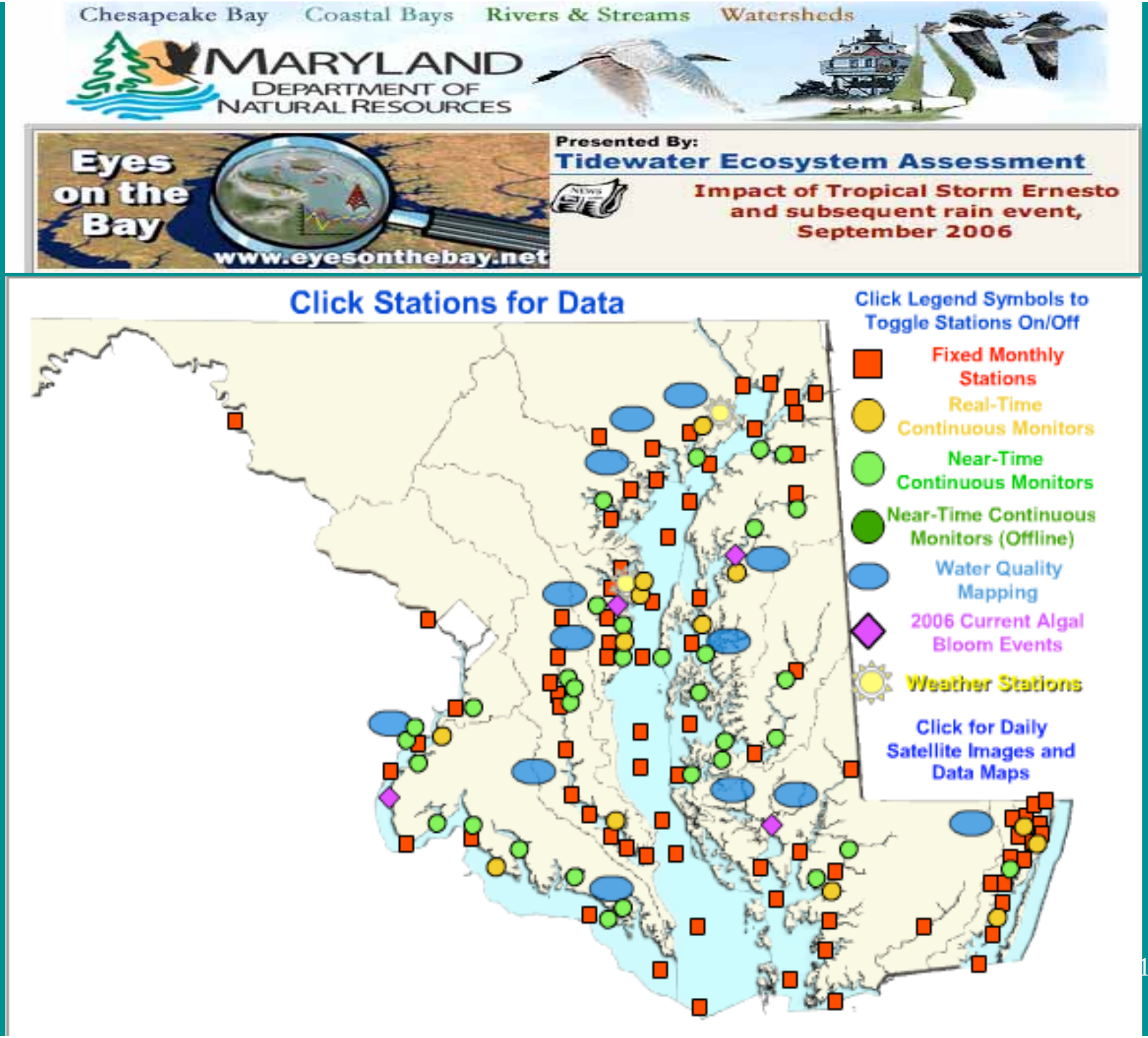
Dan Barstow


Excellence in
Estuaries
Education


TERC


Wading
B·I·R·Ds


572.500
572.000
571.500
571.000
570.500
570.000
569.500
569.000
568.500
568.000
567.500
(Feet relative to IGLD)
10/09
12:00
10/11
00:00
10/12
12:00
10/14
00:00
10/15
12:00
Date/Time (LST)
Observed WL
9063085 Toledo, OH
2006/10/09 - 2006/10/17


Chesapeake Bay
Coastal Bays
Rivers & Streams
Watersheds
MARYLAND
DEPARTMENT OF
NATURAL RESOURCES
Eyes on the Bay
www.eyesonthebay.net
Presented By:
Tidewater Ecosystem Assessment
Impact of Tropical Storm Ernesto and subsequent rain event, September 2006
Click Stations for Data
Click Legend Symbols to Toggle Stations On/Off
Fixed Monthly Stations
Real-Time Continuous Monitors
Near-Time Continuous Monitors
Near-Time Continuous Monitors (Offline)
Water Quality Mapping
2006 Current Algal Bloom Events
Weather Stations
Click for Daily Satellite Images and Data Maps

What amazing learning opportunities!

Students learn:

Physics	- wave motions
Biology	- diverse habitats
Chemistry	- salinity variations
Earth Sci	- tidal cycles
Observation	- using all the senses
Inquiry	- sparking curiosity
Technology	- access to data
Big ideas	- Earth as a system
Math	- quantitative analysis
Language	- communicating ideas
Team skills	- helping others explore

. . .and so much more. . .

Challenge #1 - Perception of Scope

estuaries

or

Physics	- wave motions
Biology	- diverse habitats
Chemistry	- salinity variations
Earth Sci	- tidal cycles
Observation	- using all the senses
Inquiry	- sparking curiosity
Technology	- access to data
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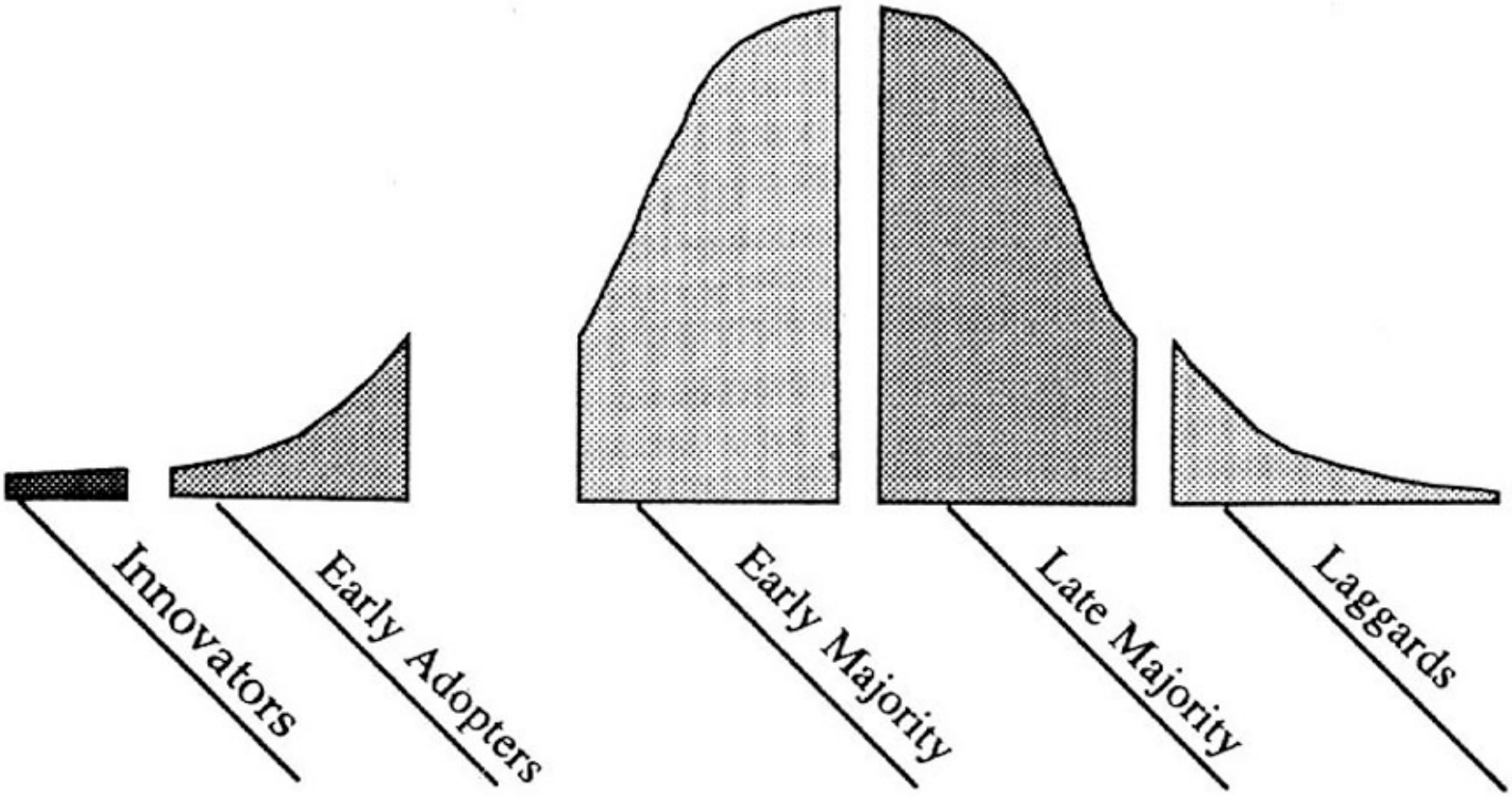
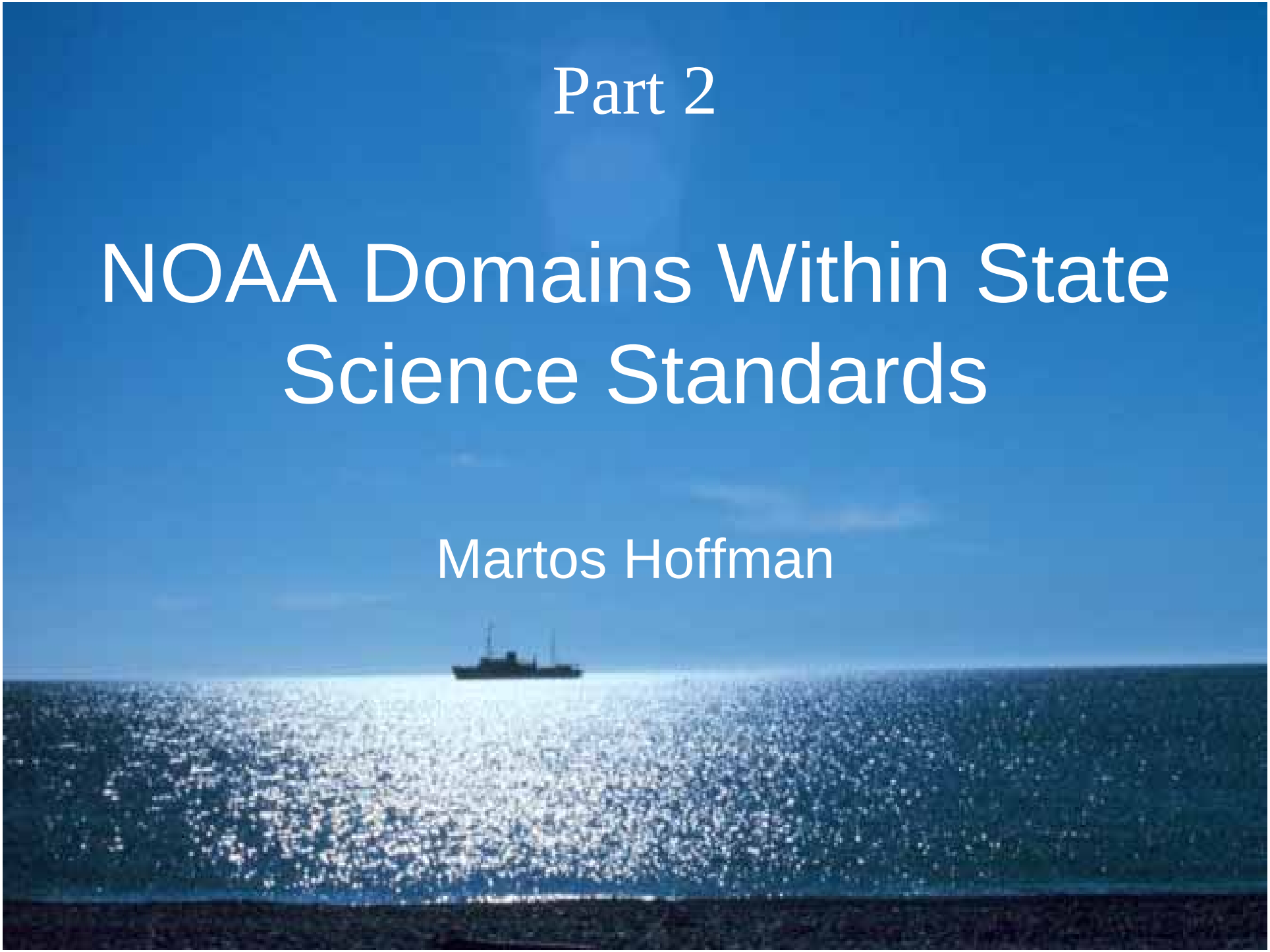
. . .and so much more. . .

The *Revised* Technology Adoption Life Cycle



From *Crossing The Chasm* by Geoffrey A. Moore

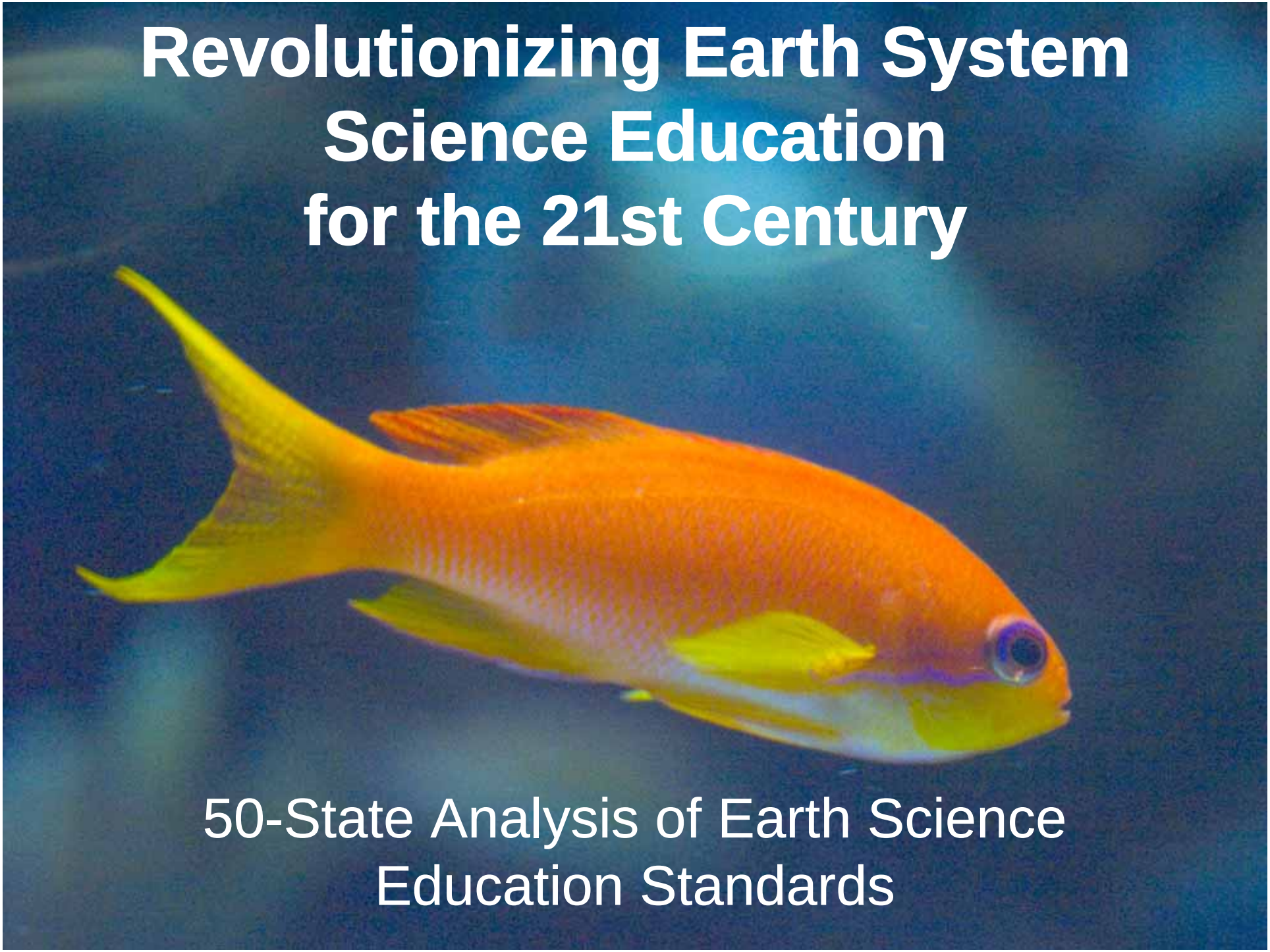


Part 2

NOAA Domains Within State Science Standards

Martos Hoffman

Revolutionizing Earth System Science Education for the 21st Century



50-State Analysis of Earth Science Education Standards


Blueprint for Change: Report from the National Conference on the
Revolution
in Earth and Space Science Education
"As our nation deliberates on education policy and funding, we, as leading science educators and scientists, call for legislators, decision makers, and stakeholders to implement all measures that support science education in general and earth and space science in particular.
Fueled by new technologies over the last 40 years, advances in Earth and space science are revolutionizing our understanding of Earth's systems and processes. This growing understanding is increasingly needed to inform political and economic decisions of local, national and global impact.
For this reason, a science-literate citizenry is vital to the nation's well-being and security and will insure our nation's continued leadership in science and technology in the 21st century. To empower the public to make sound and reasoned choices, earth and space science must be taught throughout the United States in K-12 classrooms and be accessible to all students."

Revolutionary Earth System Science

1. Earth as system
2. Inquiry-based learning
3. 21st century technology
4. Space-age perspective


NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NOAA

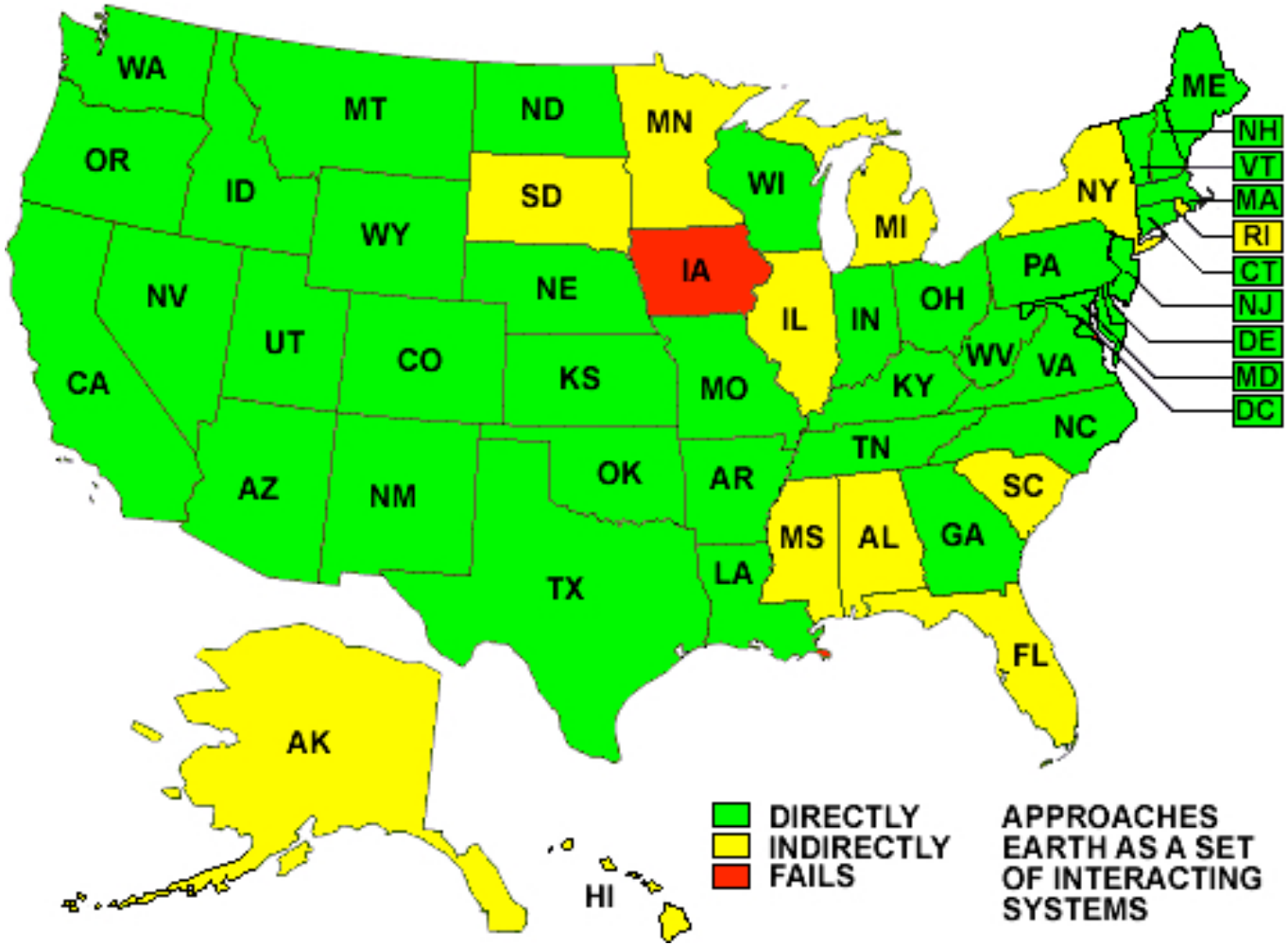
NOAA's Strategic Domains

- Ocean literacy
- Atmosphere, weather, climate
- Environmental literacy

Earth As a Dynamic Integrated System

National Grade: B+

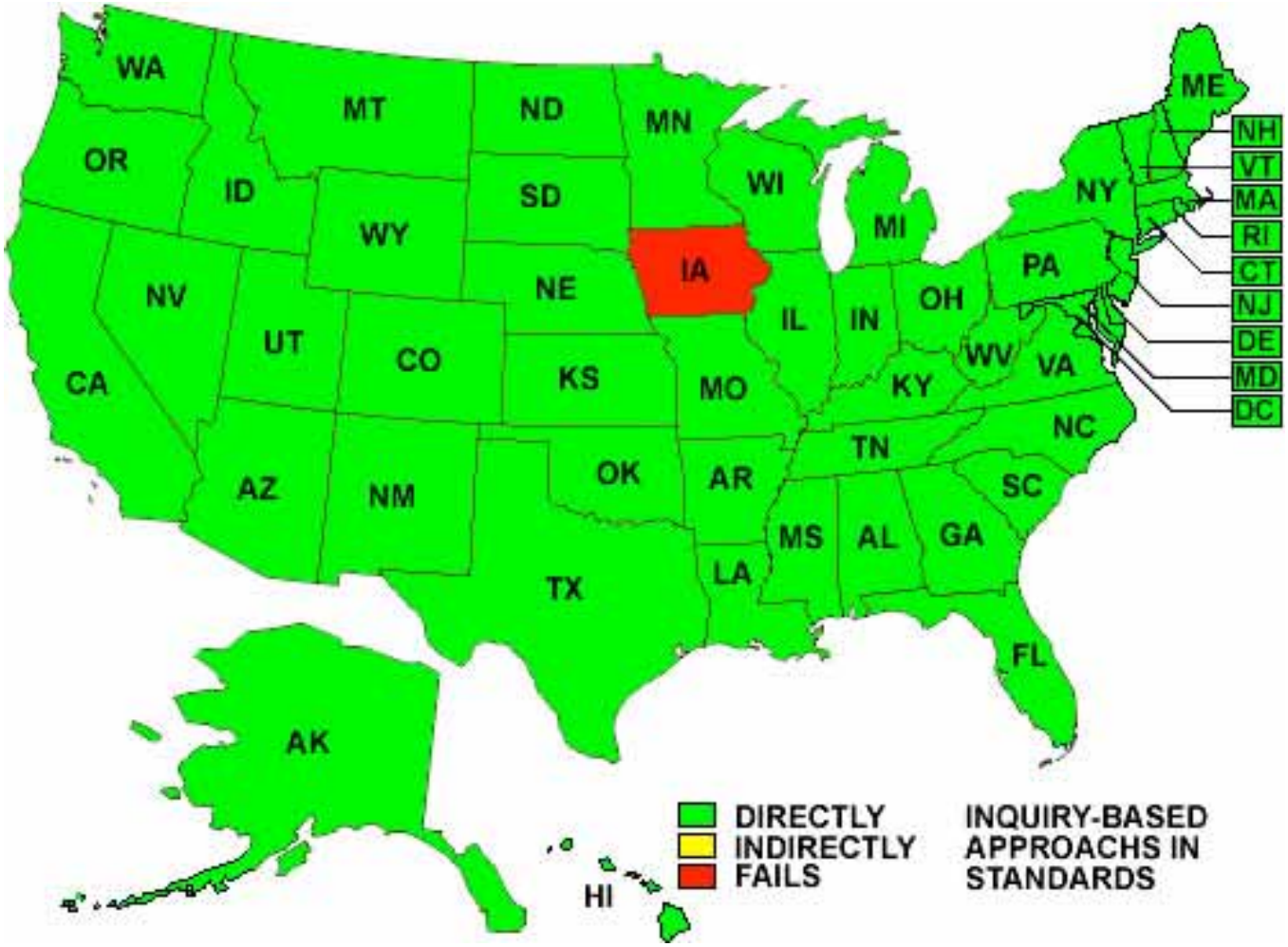
- Most states include systems
- Some states feature systems as a key approach

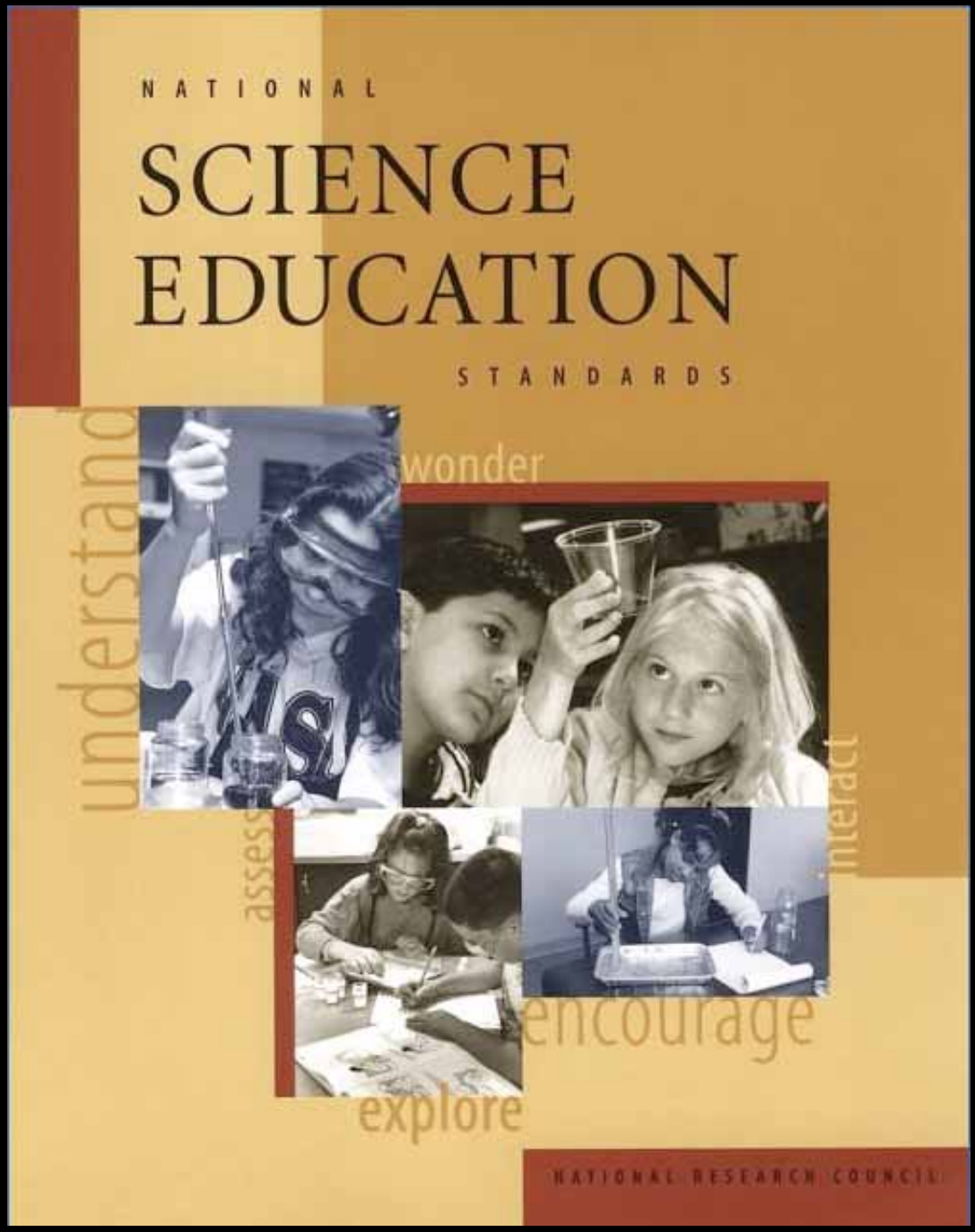


Inquiry-Based Learning

National Grade: A

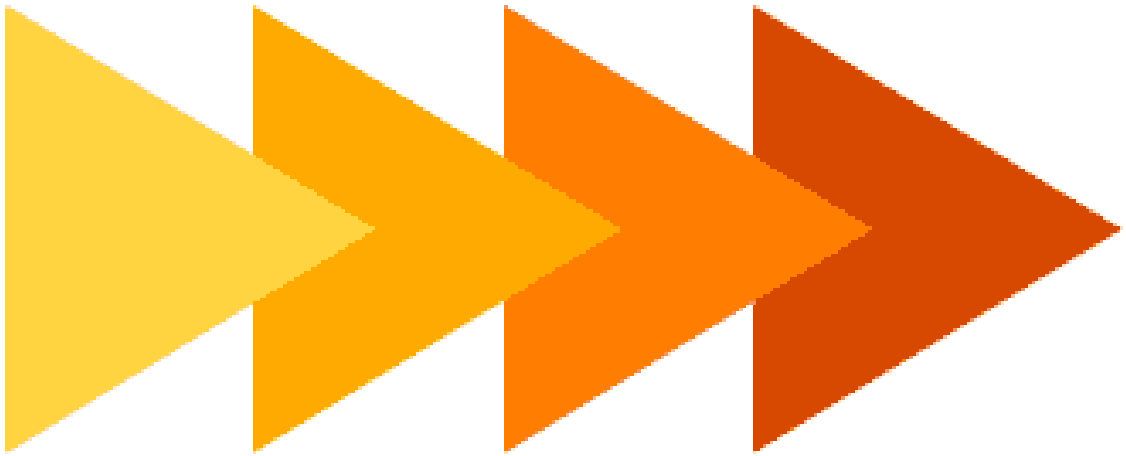
- Every state with standards employs inquiry-based learning to some degree




NATIONAL
SCIENCE
EDUCATION
STANDARDS
understand
wonder
assess
interact
encourage
explore
NATIONAL RESEARCH COUNCIL

BENCHMARKS

FOR SCIENCE LITERACY



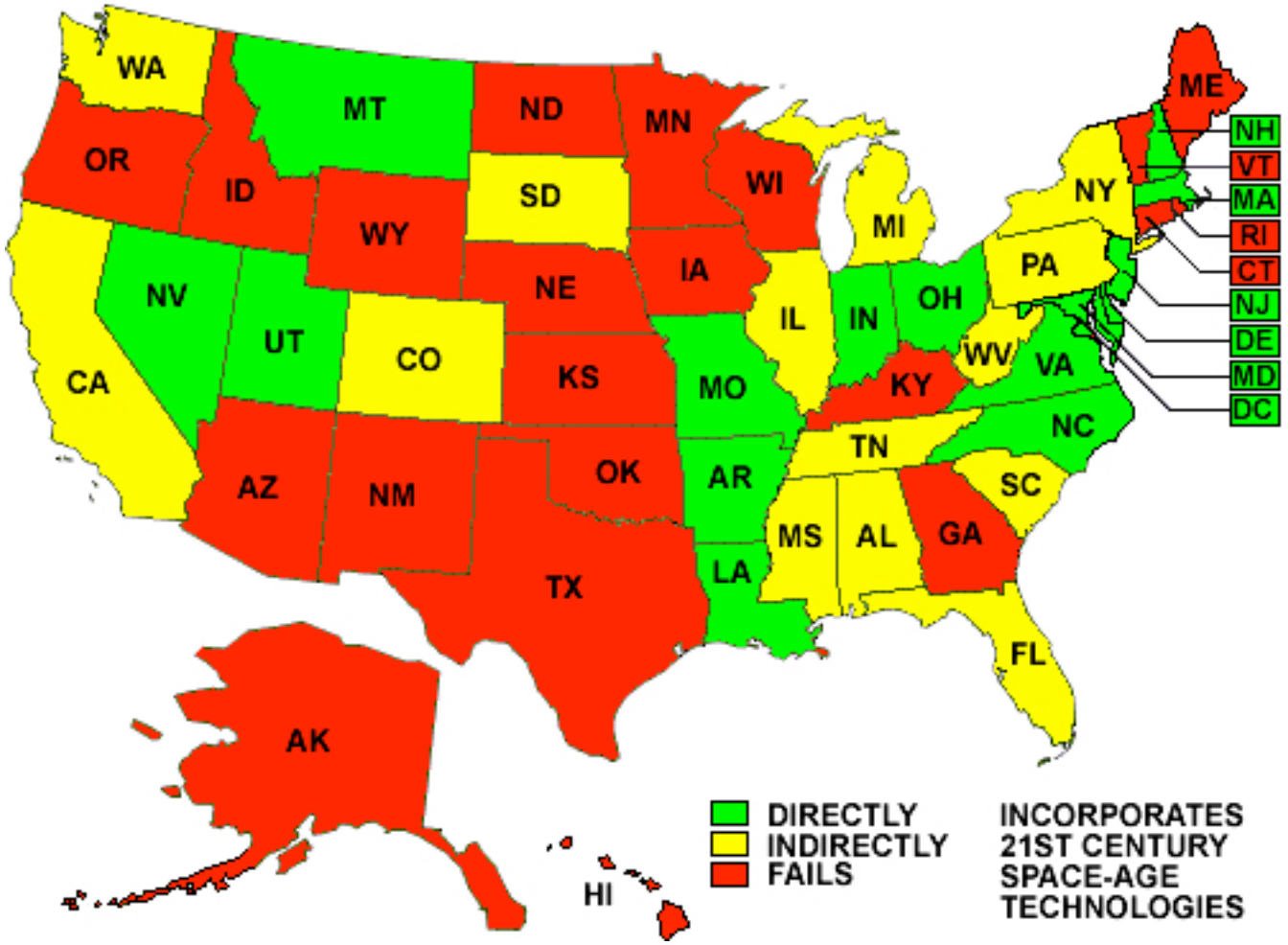
AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

PROJECT 2061

21st Century Technology

National Grade: D+

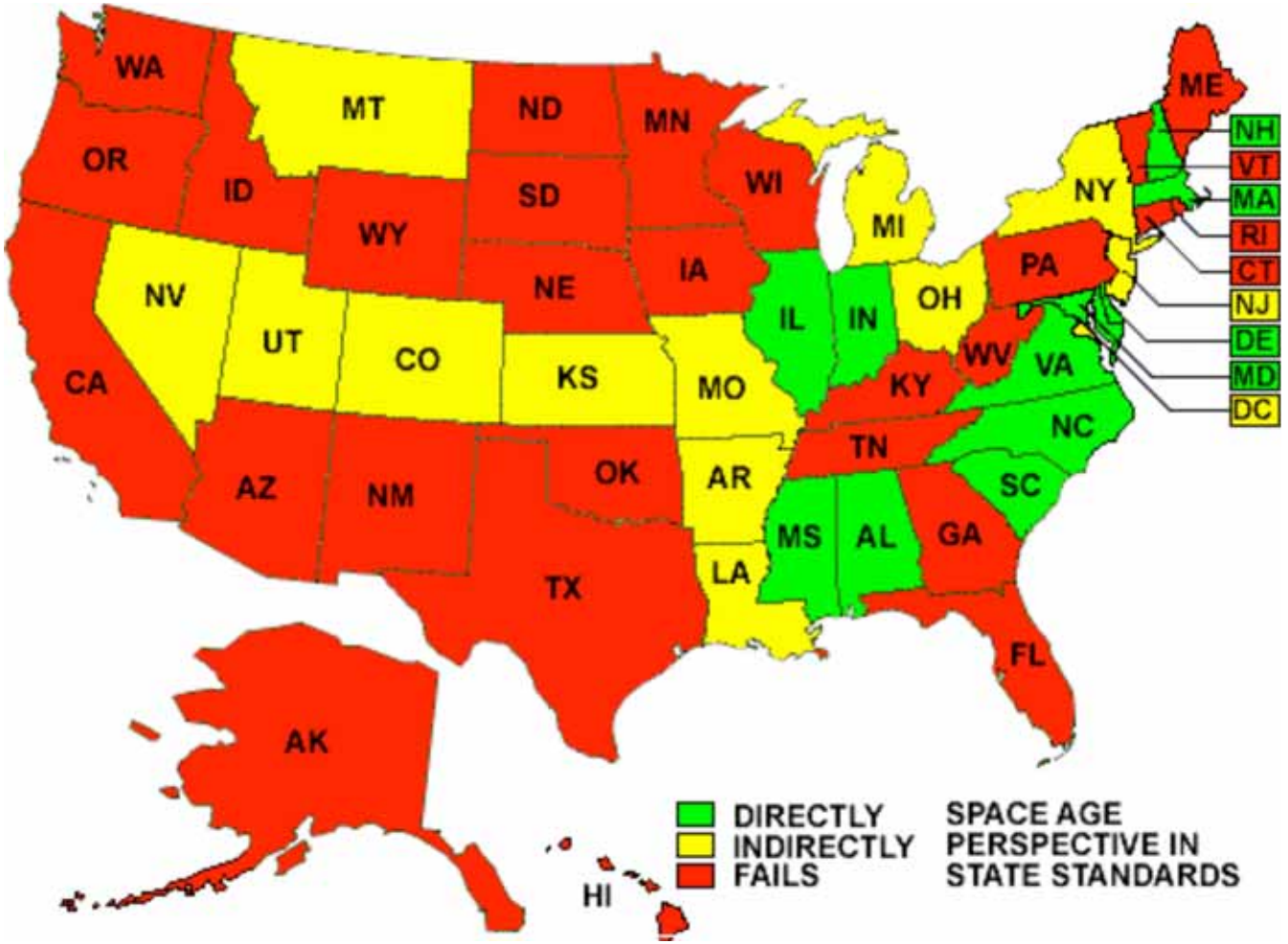
- One-third directly incorporate 21st technology
- Nearly half fail to include 21st technology

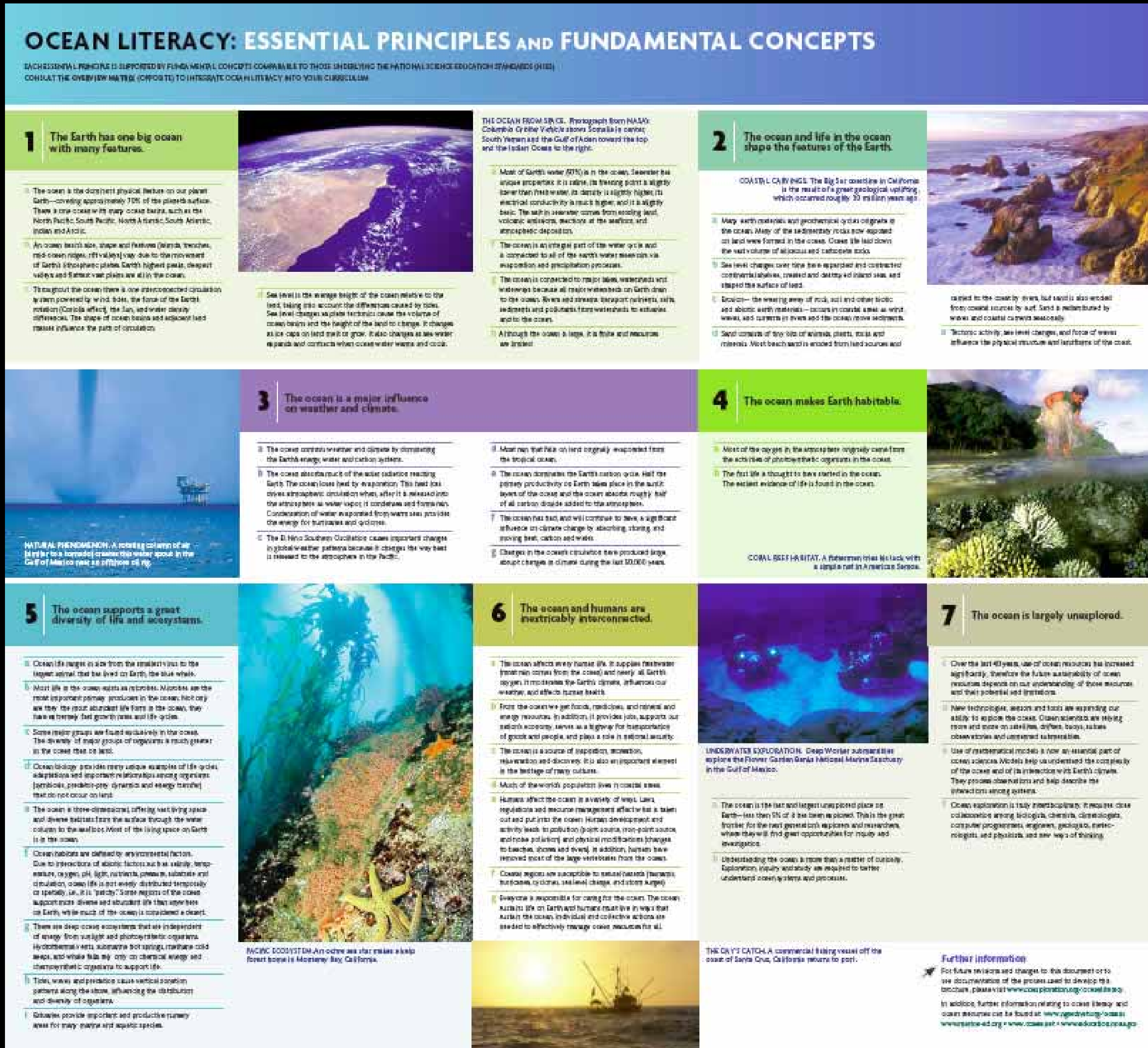


Space-Age Perspective

National Grade: D

- About one-fourth directly include space-age
- More than half fail to include in standards

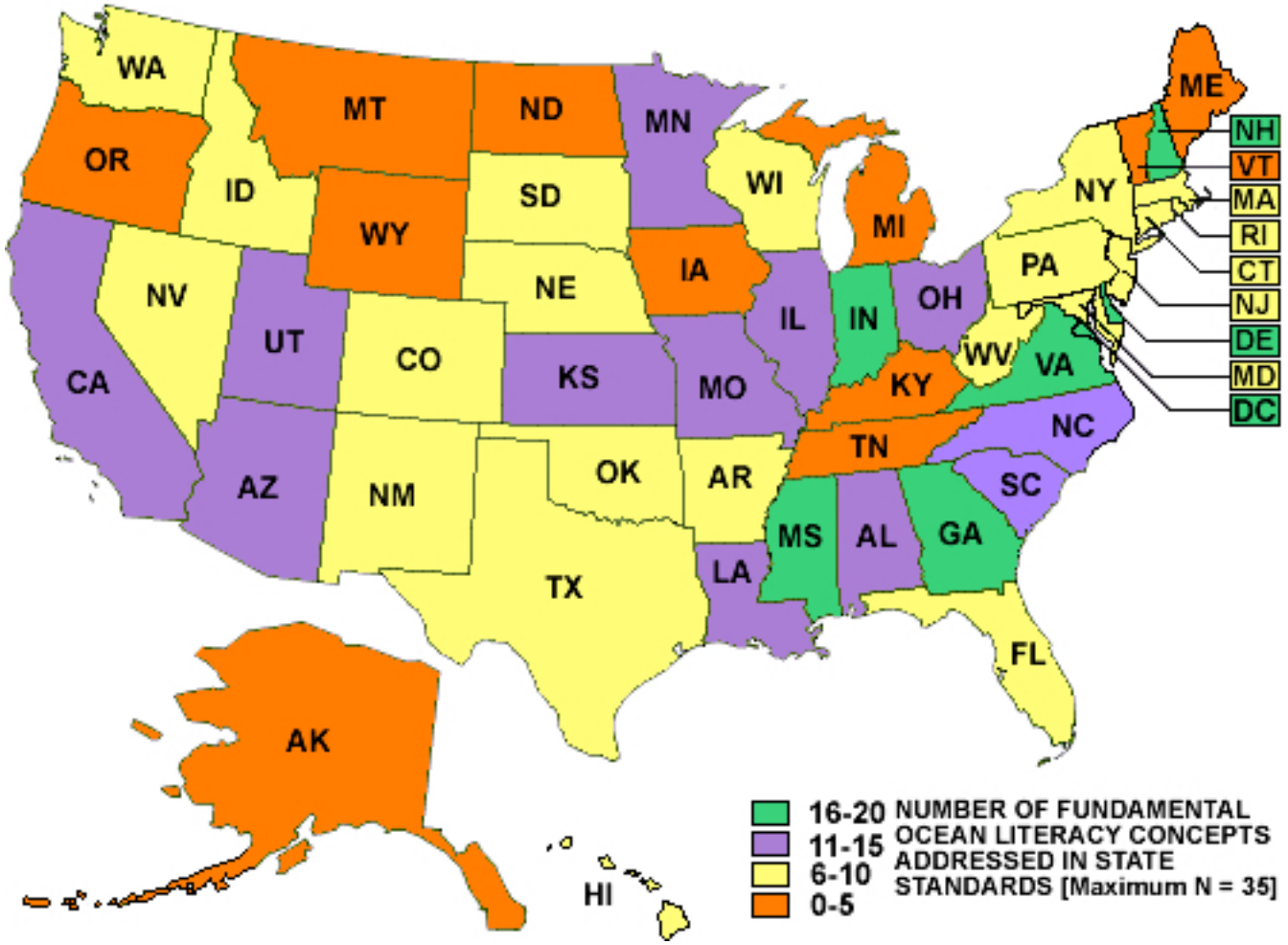



OCEAN LITERACY: ESSENTIAL PRINCIPLES AND FUNDAMENTAL CONCEPTS
1 The Earth has one big ocean with many features.
2 The ocean and life in the ocean shape the features of the Earth.
3 The ocean is a major influence on weather and climate.
4 The ocean makes Earth habitable.
5 The ocean supports a great diversity of life and ecosystems.
6 The ocean and humans are inextricably interconnected.
7 The ocean is largely unexplored.
Further information

Ocean Literacy

National Grade: D

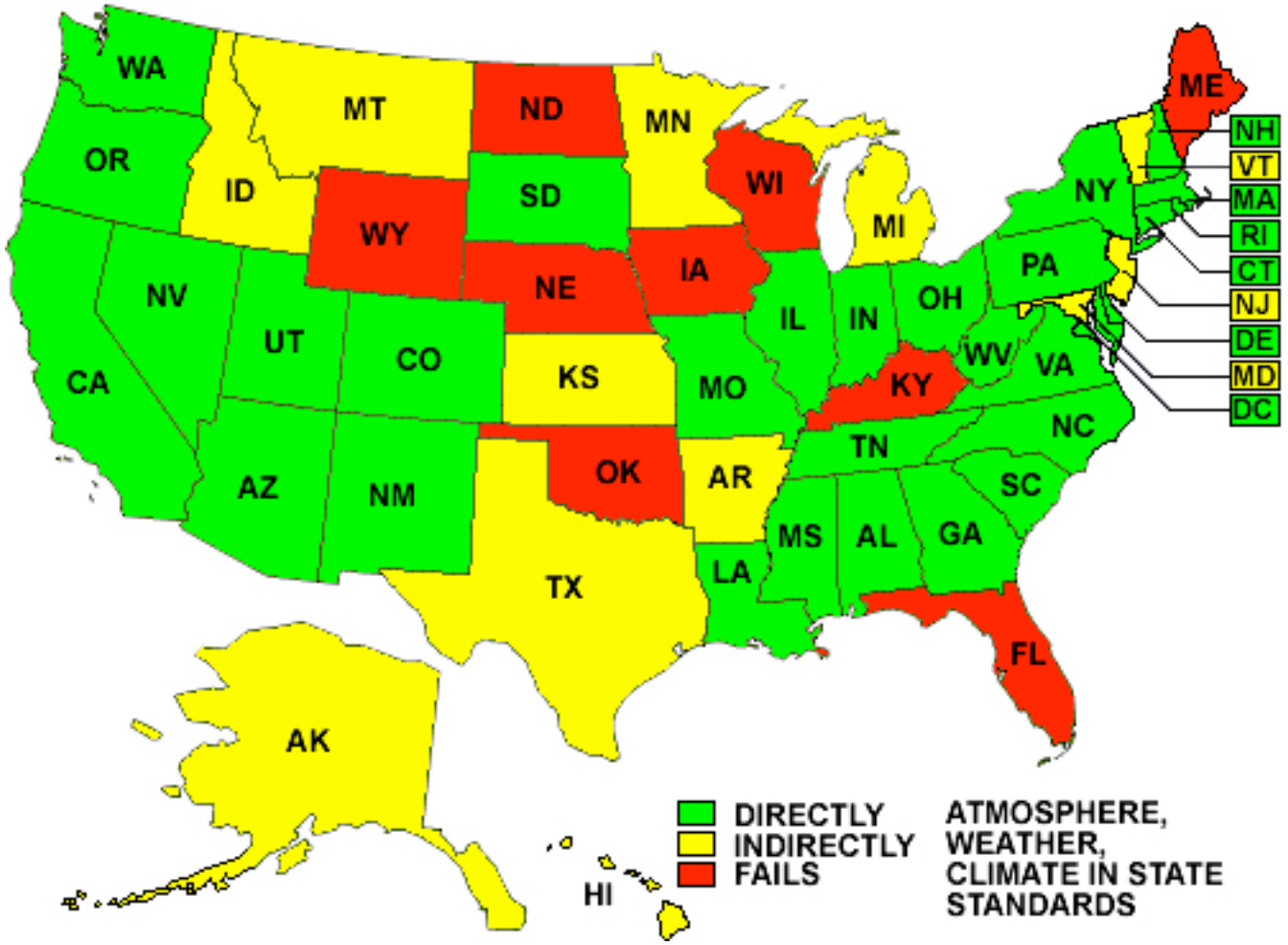
- Majority of states include some OL concepts
- Coastal states include slightly more OL concepts



Atmosphere, Weather, Climate

National Grade: C+

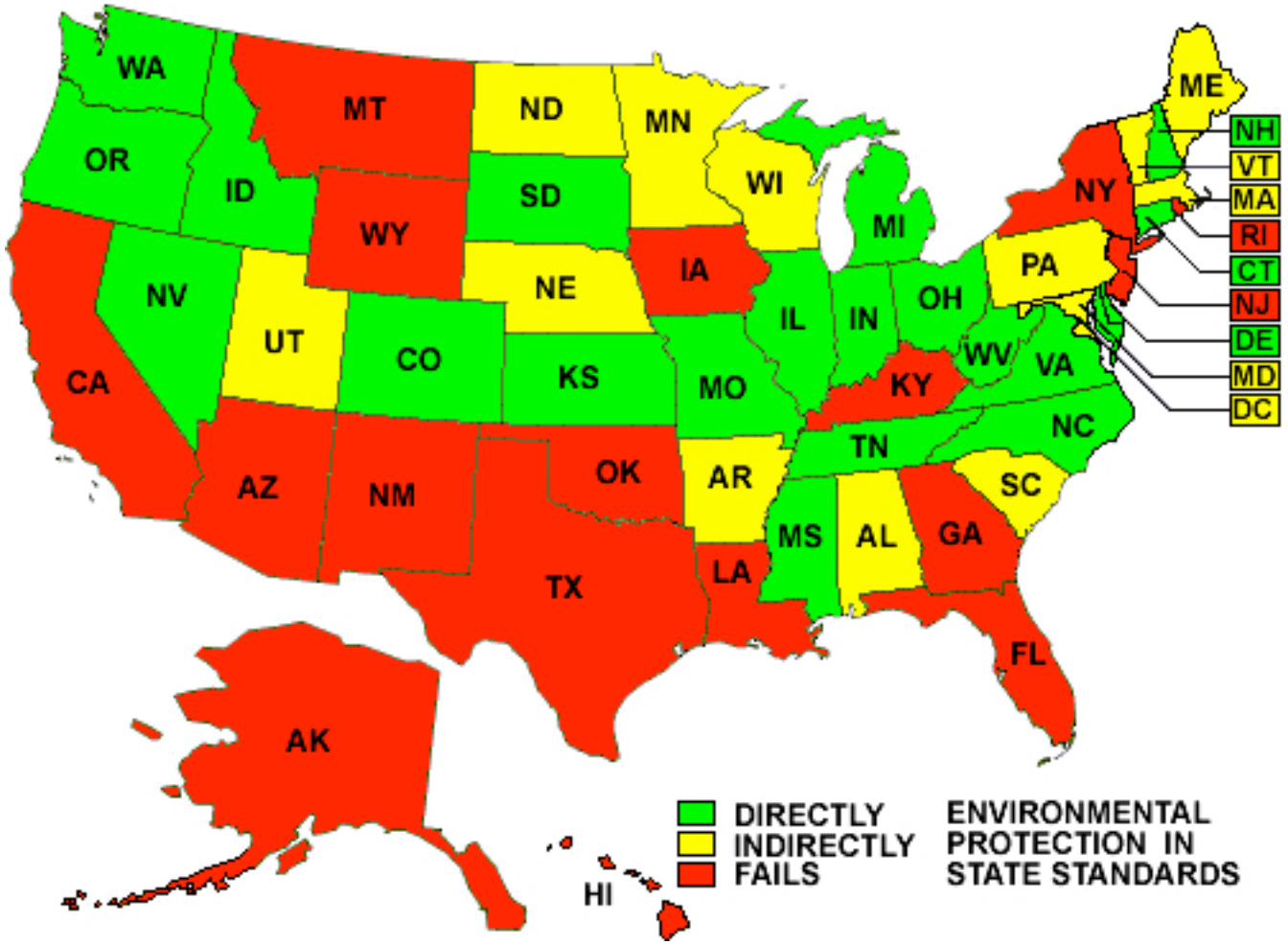
- Weather is a “classic” Earth science topic
- Florida standards do not mention “hurricanes”



Environmental Literacy

National Grade: C-

- Wide range of coverage across the country
- Applies Earth science to real world issues



Implementing the "Revolution" Improving Earth Science Education

1. Demonstrate that modern "revolutionary" Earth science perspectives and approaches result in deep student learning.
   - Develop and widely distribute model curricula.
     - Estuaries
     - Model Earth Science Lab Units
     - Other model curricula
   - Evaluate effectiveness of modern curricula and approaches.

2. Leverage key resources and research.
   - "America's Lab Report" NRC
   - "Science Content and Standards for Ocean Literacy"
   - "National Science Education Standards" NRC

Implementing the “Revolution” Improving Earth Science Education

3. Participate in state standards revision processes.
4. Influence state and national assessments--content and format.
5. Ensure that Web-based access to data and analysis tools are usable by the K-12 education community.
6. Tirelessly persist in promoting change as improvement will occur in increments.